DOCUMENT RESUME

ED 421 358 SE 061 614

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TITLE Surfing the Web for Science: Early Data on the Users and Uses of The Why Files.
INSTITUTION National Inst. for Science Education, Madison, WI.
SPONS AGENCY National Science Foundation, Arlington, VA.
PUB DATE 1998-05-00
NOTE 11p.
CONTRACT RED-9452971
AVAILABLE FROM National Institute for Science Education, University of Wisconsin-Madison, 1025 W. Johnson Street, Madison, WI 53706; phone: 608-263-9250; fax: 608-262-7428; e-mail: niseinfo@macc.wisc.edu
PUB TYPE Journal Articles (080) -- Opinion Papers (120)
JOURNAL CIT NISE Brief; v2 n2 May 1998
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Concept Formation; *Educational Experience; Educational Innovation; Elementary Secondary Education; Engineering Education; *Information Technology; *Knowledge Representation; Mathematics Education; Nonformal Education; Science Education; Technology Education; *World Wide Web

ABSTRACT

This brief offers an initial look at one science site on the World Wide Web (The Why Files: http://whyfiles.news.wise.edu) in order to consider the educational potential of this technology. The long-term goal of the studies of this site is to understand how the World Wide Web can be used to enhance science, mathematics, engineering, and technology education. Includes a preliminary look at the expertise and finances required to develop a site, patterns of site usage, and user characteristics. The results of this study can help answer questions as to whether a well-designed web site can help users understand science as well as a paper publication. (DDR)

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NISE BRIEF

REPORTING ON ISSUES AND RESEARCH IN SCIENCE, MATHEMATICS, ENGINEERING, AND TECHNOLOGY EDUCATION

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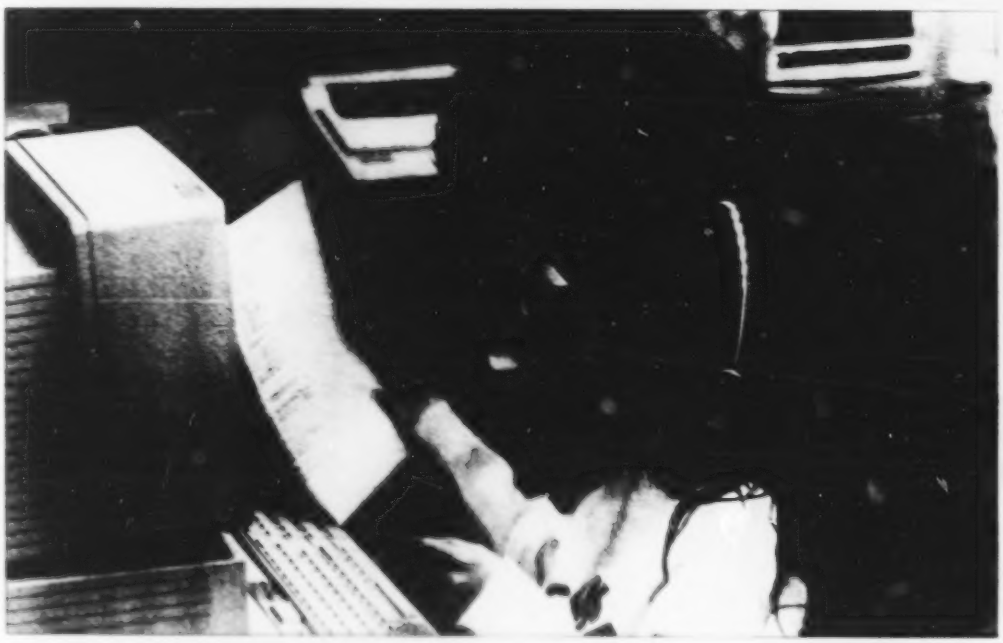
# Surfing the Web for Science: Early Data on the Users and Uses of The Why Files

by William P. Eveland, Jr., & Sharon Dunwoody



*The World Wide Web has grown exponentially in just a few years, and we have little understanding of its educational potential.*

While formal schooling plays a crucial early role in science, math, engineering, and technology (SMET) education, once such schooling ends, an individual learns most of his/her science from such informal sources as newspapers, magazines, television, movies, and museums. Social scientists and educators have devoted considerable energy to evaluating the educational potential of these channels (see, for example, Crane, 1994). However, a major new channel—the World Wide Web—is such a recent arrival that we have little understanding of its educational potential.

This Brief offers an initial look at one science Web site, The Why Files, created by NISE. The long-term goal of our studies of this site is to understand how the Web can be used to enhance SMET learning. In this Brief we offer a preliminary look at the expertise and finances required to develop and maintain a site like The Why Files, patterns of site usage, and the characteristics of the users. Such information may be helpful to those who are considering their own foray into

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communication about SMET topics on the Web, as well as those who are now using the Web but have not been able to systematically evaluate their efforts.

## The Why Files

The Web has grown exponentially in just a few years, in terms of both use and content. One can find literally hundreds of SMET-related sites, from Discovery Channel Online to the Exploratorium and the Franklin Institute. In February 1996, the NISE created The Why Files <*http://whyfiles.news.wisc.edu*>, a Web site designed to explain the science behind the news. The Why Files was charged with two primary goals: to increase SMET interest and understanding, and to serve as a test-bed to identify the benefits and drawbacks of the use of the Web to achieve these goals.

Judging from the response of Web critics, The Why Files is already a popular success. The Why Files has received award after award during its short existence, probably the most prominent among them *PC World*'s and *PC Magazine*'s inclusion of The Why Files on their lists of the best sites on the Web (Bannan, 1997; Cahlin, Lake, & Tweney, 1997).

While many science Web sites confront the visitor with an array of fairly unstructured content, some of it imported directly from a traditional print source such as a newspaper, The Why Files emphasizes original story and narrative. It does this by presenting the visitor, on the home page, with links to two current stories (called "packages"), each of which provides about twelve pages of scientific information related to recent news events.[1] The packages are normally based on current stories covered in the mainstream news media and contain links to other information and Web sites. Each package offers a strong narrative thread that encourages the visitor to follow the story from one screen to the next within the site.

In addition to the two timely packages (a new one is added every two weeks), the home page provides access to other information in the site, such as an archive of previous packages, "cool science images," a section related to sports science, a forum for discussion of SMET topics by visitors, and information about the site and its creators. The site can be searched for keywords via a site-specific search engine.

Our focus in this Brief is on the packages offered on the site, although we acknowledge that other components, particularly the forum, may also hold some potential for research. Each package contains its own bibliography page (providing both Web and print sources), a glossary of terms, and a credits page. The bibliography and glossary may be accessed in one of two ways: via in-text links, or through a navigation bar at the bottom of each page. Similarly, each page of the story itself (see Figure 1 for an example) can be reached from any other page in the package via the navigation bar. Movement between pages is also possible via in-text links, with the last sentence of each page—a teaser for the next page—always including an in-text link to the next page. In addition, the previous and next pages are accessible through prominent buttons at the bottom of each page, as is The Why Files home page and the "story map" or index page for the story. Finally, links in the text also provide direct access to additional information available elsewhere on the Web.

## The Creation and Maintenance of The Why Files

Several types of expertise are required to update and maintain a site like The Why Files. At the most basic level, a strong "webmaster" with the appropriate programming skills, Web savvy, and computer expertise will maintain and upgrade the site and handle any technical challenges. The creation of excellent content for the site—an absolute necessity for success—requires the services of a skilled communicator who understands how to write specifically for the Web and a talented graphic artist who structures the written content of the site and complements it with interesting and informative visuals. Also important is the assistance of an experienced editor/coordinator who can help shape the content of the site both broadly—by influencing story choices—and narrowly by helping to polish the finished product. All of these people should have a solid understanding of the content available on the Web and of popular culture more generally. Finally, having the structural support of a major university and easy access to faculty in science and related departments makes maintaining and updating a site like The Why Files much easier.

The cost of launching, updating, and distributing The Why Files appears to be considerably less than that for a comparable print magazine. The initial investment in hardware required to start up The Why Files in 1996 was approximately $40,000. This primarily funded the purchase of the server (the computer that stores and delivers The Why Files to Web users) and desktop computer equipment and software for the staff. The cost to maintain and update The Why Files every other week works out to slightly less than $250,000 per year. While this may seem expensive, this amount covers staff (approximately 100 hours per week invested across all the experts on the team), supplies, travel, equipment, phones, and overhead costs.

A comparable color print magazine that did not accept advertising (The Why Files has rejected offers of advertising revenue) would experience similar operating costs, but would require even more funds for printing (we estimate about $1 per 16-page "issue" of The Why Files) and mailing (about 20 cents per copy). Considering that approximately 20,000 people visit The

**Figure 1:**
**An Example of Navigational Possibilities in a Why Files Package Page**

# Wheezin' season

**Too many causes, too much disease**

In their search for the causes of asthma, scientists have blamed lots of disgusting stuff, like roach parts and mite scats. They've also found a few asthma triggers that aren't so disgusting, like cold, dry air.

And even a few that should be healthy, like exercise.

Many, indeed most, cases of asthma, particularly among children, have allergies as a major component. Allergies to what? Well, dust mites, pollen, animal dander (glossary), cockroaches, and certain foods. Different people have different allergies, obviously. Intriguingly, an allergen that sets off a sneezing fit may or may not set off an asthma attack--even in the same person.

*In-text link to the glossary.*

*In-text link to another Why Files page.*

Tobacco smoke: to the smoker or nearby victims, can irritate the airways.

*In-text link to leave site.*

Roaches: A recent study of asthmatic children in eight inner-city neighborhoods found that similar numbers of children were allergic to roaches (37 percent) and dust mites (35 percent). Yet roach-parts seemed much more potent in triggering asthma: 50 percent of the kids' rooms contained roach allergen, compared to 10 percent containing dust-mite allergen. And the roach-allergic kids who lived in roach-infested houses were admitted to hospitals three times as often as other asthmatic kids in the study. "The combination of cockroach allergy and exposure to high levels of this allergen may help explain the frequency of asthma-related health problems in inner-city children," the researchers concluded (see "The Role of Cockroach Allergy..." in the bibliography).

*In-text link to the bibliography.*

*In-text teaser link to the next linear page.*

Are all asthma triggers so disgusting?

*Buttons.*

THE Why FILES back story map next

*Navigation bar.*

A NISE Project [funded by NSF] TALK to us...

There are 1 2 3 4 5 6 7 pages. Bibliography | Glossary | Credits | Search

**Note**: Underlined text represents a hypertext link. The "buttons" also serve as hypertext links.

## The Why Files

The Why Files is designed to communicate SMET information to the general public. Given this goal, however, the site may be used in at least two different contexts and in at least three different roles.

### Contexts

First, The Why Files may be used in an informal learning context by people who are interested in SMET information generally or some SMET topic in particular. They may come upon The Why Files by following a link from another site (browsing) or through a Web search engine like Yahoo, Lycos, or Alta Vista (searching).

Similarly, The Why Files may be used in a formal learning context by teachers and students at most grade levels (elementary through college). The Why Files may be included in lesson plans as a multimedia aid to instruction for teachers, or it may serve as a classroom resource for students to use when writing papers or for finding up-to-date information not available in textbooks.

### Roles

The Why Files may also be used in several different roles: as an up-to-date science magazine that helps explain the science behind current news topics, as a searchable archive of SMET information, or as a discussion group for SMET-related topics. The current packages on the site serve as a science magazine somewhat like *Discover* or *Popular Science*. In addition, The Why Files search engine allows users to search the site–both current packages as well as all the archived packages–for keywords of particular interest or use to them, much like an electronic encyclopedia. Finally, The Why Files forum area provides an opportunity to ask other users questions and to discuss not only information available in the site but also SMET topics more generally.

Examples of archived package titles, by category:

| Biology | Health | Social Science |
|---|---|---|
| Cloning | Asthma | Fear |
| Forensic Science | Gulf War Syndrome? | Polling |
| Migration | Spinal Cord Repair | Stock Market |
| **Environmental Science** | **Physical Science** | **Technology** |
| Air Pollution | Comets | Air Bags |
| Tornado Watch | Neutrinos | Solar Electricity |
| Volcanoes | Tornadoes | Plane Crashes |

Why Files during each content cycle, one would need an additional $25,000 or so every two weeks to produce and distribute a comparable print version. Worse, as the print version increased in popularity, the costs of printing and mailing would similarly increase. The same is not true for The Why Files. Even if an additional server were required to meet the increased demands of new users, this expense would not amount to more than one print issue's production and mailing costs.

Unfortunately, we are unable to compare the costs of The Why Files with the costs of other comparable Web science magazines, because site managers are typically unwilling to share this type of information. However, relative to a comparable print magazine, The Why Files is clearly a cost-effective means of distributing science information to an interested public. Still, it is truly effective only if users are actually reading and learning from its content.

## Research Questions

Hypermedia systems, which are interconnected pages or "nodes" of information navigated via associative links, have been the topic of research for quite some time, at least since the mid-1980s. The World Wide Web can appropriately be considered the largest and most diverse hypermedia system in existence. Unfortunately, space does not permit us to delve into the relevant theoretical and empirical literature on hypermedia systems. Briefly, however, this literature is found primarily in journals pertaining to computer science, library science, and educational technology, and the research focuses on small hypermedia systems designed for classroom instruction. Little to no research has been published examining the uses and effects of informal science learning sites on the Web. Indeed, few empirical studies of the uses and effects of the Web in any context have appeared in academic journals to date.

Our recent review of the cross-disciplinary literature on hypermedia uses and effects (Eveland & Dunwoody, 1997; see also the publications listed under "For Further Readings") suggests several questions of particular importance that we will address in this Brief. First, who is making use of The Why Files? Is there a demographic bias in the characteristics of users, compared to the population at large or the population of Web users? Research on the diffusion of the Web and other new technologies provides strong evidence that the more advantaged members of a population are the first to adopt, and thus benefit from, new technology (CommerceNet, 1997; Rogers, 1983). Further, prominent diffusion researcher Everett Rogers (1983, p. 398) has argued that "the consequences of the adoption of innovations usually tend to

widen the socioeconomic gap between the audience segments previously high and low in socioeconomic status." This finding is discouraging to those who hope to use technological innovations to *reduce* information gaps between the haves and have-nots in society. But over time, as the diffusion process takes place, these biases are typically reduced or eliminated (CommerceNet, 1997; Compaine, 1988).

Another potential biasing factor is that the same people who are most likely to adopt innovations are also typically the most interested in and attentive to SMET topics: males with relatively high levels of formal education (Miller, 1986, 1996). If use of The Why Files follows the same demographic pattern, there is the potential of doing no more than preaching to the choir, so to speak, at least in the current stage of the diffusion of the World Wide Web.

The second question we pose in this Brief pertains to the "what" and "how" of site use. What types of patterns are evident in the use of The Why Files? More specifically, is movement through the site linear, like the reading behavior produced by standard print sources, or is it nonlinear, as expected by designers of hypermedia systems? Theoretical work on the benefits of hypermedia suggests that, when users with some expertise in an area are provided with the opportunity to follow their own paths and construct content based on their individual needs (the common notion of "learner control"), they should be more motivated to continue learning and better able to learn the new information. However, research on learner control indicates that, in order to make the most of a learning situation, novices typically need some structure or advice in making choices until they better understand the content domain. Empirical evidence about how users maneuver through The Why Files should give us a better understanding of whether they browse nonlinearly or whether they make use of the features designed to help those who need some advice in their navigation.

A final question we pose here is, do visitors make use of site features designed to foster increased understanding, such as the glossary, bibliography, and links to sites with further information? Unlike print sources, where finding and making use of supplementary information is difficult and time consuming, access to additional information on the Web is nearly immediate and requires little effort. In this case, users who desire a more detailed understanding of a topic should be more likely to make use of these features on the Web than in print and could, thus, benefit from the additional understanding they can provide. Use of these features may signal more active and systematic processing of the information available in the rest of the site.

## Methods of Data Collection

Thus far, our study of users of The Why Files has included the collection of two types of data: survey data collected by a questionnaire electronically distributed to repeat users of the site, and computer-collected audit trail data representing the sequentially ordered file requests made by users.

### *Survey*

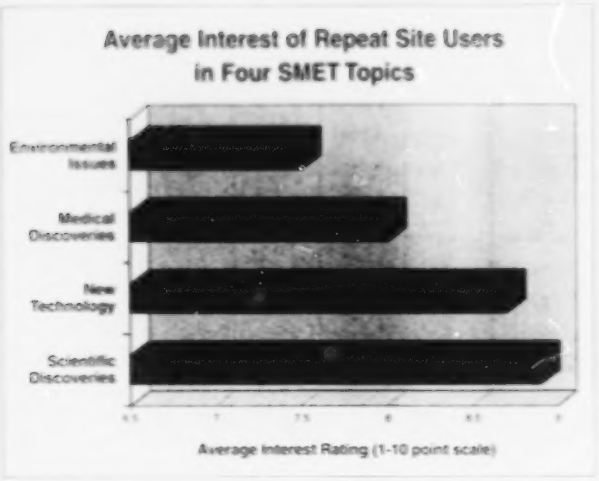
In order to understand the characteristics of users of The Why Files, we developed a brief questionnaire (requesting information about demographic characteristics, Web use frequency, and interest in SMET topics) that was incorporated into the site. An initial examination of audit-trail data had indicated that most users encountered the home page at some point in their visit, so the survey was attached to all links on this page. When a person who had visited The Why Files on at least two previous occasions clicked on a link on the home page, he/she was asked to fill out the survey. We decided to limit the survey to users who had previously visited the site at least twice in the two weeks prior to the survey or during the two-week survey period itself (March 20 through April 3, 1997). We made this decision because we were interested in the characteristics of the frequent or core users of the site, in much the same way that a print magazine would be interested in the characteristics of its subscribers and regular readers more than those who read the magazine once a year in the dentist's office. Our response rate for this survey was 63 percent, providing us with a sample of 399 repeat users of The Why Files.[2]

### *Computer-Collected Audit Trail Data*

World Wide Web servers routinely collect data on the requests made for files at the site. Each time a file is requested from the server (i.e., someone clicks on a link to select a page from the site), the server makes a record of the time, the particular file requested, and so forth. Although individual users remain anonymous, by assigning a random number to each new user we are able to identify and track any subsequent requests.

These "audit trail data" have both strengths and weaknesses compared to self-reports of behavior as might be measured in a survey. One strength is that it eliminates inaccuracy caused by forgetting, or by intentionally overreporting socially desirable behavior. Further, data may be collected unobtrusively and thus are not susceptible to reactivity biases.

However, a growing number of users are able to defeat the data collection devices on Web sites (eliminating their behaviors from the data) and thus confound the results. Software programs used to browse the Web (i.e., Netscape, Internet Explorer) for the past few years have included a once-little-known option to enable users to prevent their information from being recorded. Recent changes to these software programs


Average Interest of Repeat Site Users in Four SMET Topics
Environmental Issues
Medical Discoveries
New Technology
Scientific Discoveries
Average Interest Rating (1-10 point scale)

have made this circumvention even easier. Further, some Web users have been quite vocal about their opposition to the use of these data collection measures, creating a highly publicized issue that has made more users aware of, and more likely to use, the available software options to defeat audit trail data collection. Another weakness of this particular audit trail study is that limitations in the available data collection software led to some systematic *under*reporting of some types of site use, specifically the use of navigation tools built into the browser software of the user.

The audit trail data were collected in three two-week censuses (i.e., all use of the site during these periods) during late 1996 and early 1997. The information collected may be best understood by analogy to information about the use of a museum. During the first data collection period (Time 1, in late November and early December 1996), there were approximately 180,000 *requests for pages* received by the site (analogous to the number of paintings viewed in a museum), representing 52,000 *separate visits* to the site (analogous to the number of tickets bought to the museum) from 18,000 *different individuals*. Use of the site was down slightly during Time 2 (late December 1996 and early January 1997), with 125,000 requests for pages from 37,000 visits by 16,000 individuals. However, by Time 3 (late March to early April 1997) site use was back to normal with 175,000 page requests from 37,000 visits by 24,000 individuals.

We believe that the popularity of The Why Files is in part a function of marketing efforts undertaken to publicize the site and its contents. Press releases have been sent to print media outlets, presentations have been made at professional meetings (e.g., the National Education Association convention), business cards with the site address have been distributed, and the site has been displayed in some museums. In addition, site managers have registered The Why Files with search engines on the Web to make it easier to find for those searching for SMET content. Possibly the most important publicity has come from Web site evaluators, who have consistently identified The Why Files as an interesting and informative site. These endorsements on the Web (e.g., Yahoo, Microsoft Network, HotWired) and in print (e.g., *PC Magazine, PC World*) are likely to have encouraged many people to visit the site. Despite these marketing efforts, it is the timely nature of the quality content that is the most likely reason that people *return to the site*.

Although it will be important to eventually compare these site use numbers to those of other Web sites designed to communicate SMET information to the public, few commercial science Web sites are willing to share their site usage data. Those sites (commercial and noncommercial alike) that are willing to reveal usage information typically provide only the number of "hits" their sites have received. While many believe that hits describe either the number of individuals visiting a page or the number of page requests, these interpretations are incorrect in almost every case. Instead, hits record the loading of minute page components such as icons and images (many of which occur on any single page) and, therefore, are typically an extreme overestimate of the number of individuals or even page requests. Thus, hits are not comparable to the more detailed and precise information on site use described above. (For a good visual representation of the distinction between hits and what we call page requests, see *<http://cnn.com/TECH/9707/07/pathfinder.internet/page.vs.hits.jpg>*)

## Preliminary Findings

The results of our preliminary research on the users of The Why Files are presented below in two stages. First, we describe the findings of the survey, which provide a description of the users. Second, we describe aggregate patterns of use of The Why Files based on the audit trail data.

### *Characteristics of Users of The Why Files*

The survey of repeat users revealed the expected educational and gender biases. Repeat users of The Why Files were more highly educated (the modal user had a graduate degree and the median user had a bachelor's degree) and more likely to be male (69 percent) than the general population of the United States. The average respondent was about 37 years old; only about 10 percent were 18 or younger. They were also heavy World Wide Web users, reporting using the Web on average about once a day in the month before the survey.

As expected, repeat users of The Why Files were very interested in SMET topics, rating around 8.25 on a 1-10 scale with 10 representing "extremely interested." However, their interest in SMET topics was not without variation. Overall, respondents were most interested in science discoveries ($\bar{x}$ = 8.9) and new technology ($\bar{x}$ = 8.7), and somewhat less interested in medical discoveries ($\bar{x}$ = 8.0) and environmental issues

($\bar{x}$ = 7.5). Our findings indicate that women and older respondents were more likely than men and younger respondents to be interested in medical discoveries. Women also were more likely than men to be interested in environmental issues, but men were more likely than women to be interested in new technology.

### *Patterns of Use of The Why Files*

Using the audit trail data, we can also begin to answer the question of how people use The Why Files. The most interesting issue here is whether people make use of the ability to move nonlinearly around the site or whether they ignore this much-touted feature of hypermedia systems. Our initial evidence suggests that users of The Why Files eschew the nonlinear options and use The Why Files in much the same way that people use newspapers and other print sources.

The evidence for this conclusion takes several forms. First, when users are in a package, the overwhelming tendency is to move to the next page in the site rather than examining bibliographic sources, checking definitions of words, or following links to other pages in the site or links to pages outside the site. Across the six current packages for which we have data (two per sample period), of those users who were on a page in a main package and selected another page to view, about two-thirds selected the next page in that package. By comparison, only 5 percent selected a link to the bibliography, only 8 percent selected a link to the glossary, and only 7 percent selected any particular link outside the site. Thus, the features most highly touted in the theoretical literature on hypermedia systems were those least used in The Why Files.

Is this linear movement through a package passive or does it represent an active decision to go to the next page of the story? Our data provide some insight into the nature of this movement by allowing us to determine not only where users go, but how they got there. Those who wish to move from one page to the next in a package have three options: clicking the in-text link at the end of the text on that page, clicking the "more" page-turning button at the bottom of the page, or clicking the next page number in the navigation bar at the bottom of the page. Similarly, the bibliography and glossary may be accessed through either in-text links or the navigation bar at the bottom of the page (see Figure 1). Someone inattentively browsing the site would have easy access to the "more" page-turning button or the page numbers in the navigation bar at the bottom of the page, so a superficial user may be more likely to select the next page via these prominent graphic devices. The word or phrase link at the end of the text, however, may require a more sustained investment in reading to be interpretable as representing a move to the next page. Thus, using information regarding what type of link is being used (regardless of where it sends the user) can give us some indication of the relative activity of movement through the site.

The results indicate that, across the three data sets, 72 percent of file requests initiated from within the current packages were made by using an in-text link (this includes requests for pages inside and outside of the site), while about 20 percent were made with use of the page-turning buttons and only 8 percent were made using the navigation bar. Therefore, the two more passive options that are based on a paper text metaphor — the page-turning buttons and the page-numbered navigation bar — are the least frequently used by those who visit The Why Files. Instead, visitors seemed to be reading the page and then clicking on a word or phrase in the story to move on to the next page.

*As Web access becomes more democratic and representative of the general population, users of The Why Files and other SMET sites should become more like the population at large.*

## Implications of Our Findings

### *Users of The Why Files*

Consistent with past evidence from the diffusion of innovations literature, use of The Why Files is biased along education and gender lines, with 69 percent of the repeat users being male and approximately 70 percent having at least two years of college education. However, this bias is not as strong as one might expect considering that the population available to The Why Files — Internet users — is itself almost 60 percent male and highly educated (more than two-thirds have at least attended college) at the present time (CommerceNet, 1997; Wirthlin Worldwide, 1996). Thus, while the users of The Why Files are clearly unlike "typical"

Americans, they are very much like "typical" Web users. Similarly, considering that education is strongly related to the use of popular science magazines, and that twice as many men as women read these magazines (Miller, 1996), the fact that educated men are the most likely to be repeat users of The Why Files is not a great surprise.

The bias in use of the site may be largely a function of biases in access to and use of the Web more generally. If this is true, then as Web access becomes more democratic and representative of the general population through government intervention (through schools and libraries) and technological advances, users of The Why Files — and potentially other SMET sites — should become more like the population at large. The history of new technology diffusion has demonstrated that biases in users of innovations decrease as time passes, with many technologies, such as television and the telephone, eventually becoming nearly universally available (Compaine, 1988). Recent data indicate that this process has already begun on the Web (CommerceNet, 1997). The process of democratization should be further advanced by new developments such as Web TV, which bypasses the complex home computer and allows access to the Web through one's television set at the cost of just a few hundred dollars. These developments will make access to the Web independent of the large financial and technological hurdle of computer ownership, thus decreasing the initial monetary outlay and simultaneously eliminating the need for much of the technological savvy normally required to connect to the Web.

### *Use of The Why Files*

Our research indicates that The Why Files reaches about 20,000 different individuals during each two-week content cycle. Although we are unable to compare this figure to other science-related Web sites, circulation rates for print periodicals are available for inspection. Comparisons between the use of The Why Files and use of these periodicals should be made with care, however, because of a lack of precision (circulation represents sales, not use or readership, which may be either higher or lower than circulation, especially when circulation is linked to organizational membership) and different publication schedules (monthly or weekly for print periodicals vs. every other week for The Why Files).

Mass-marketed science magazines such as *Discover* (1.2 million monthly), *Popular Science* (1.8 million monthly), and *National Geographic* (9 million monthly) clearly outpace The Why Files in number of users. Even less accessible

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## FOR FURTHER READING


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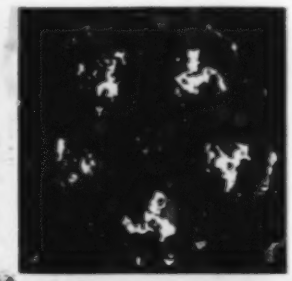
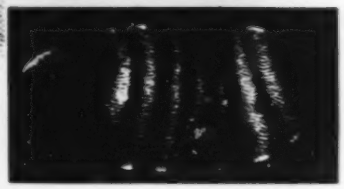
**http://whyfiles.news.wisc.edu**

The "Cool Science Image," updated weekly, allows visitors to the Why Files to see a volcano through the eye of a satellite, a comet through the eyepiece of a state-of-the-art telescope, or a developing fruit fly embryo through a microscope. Images have included electron scanning microscope images of blood cells, crystals, bread mold, nerve cells, and velcro!





*Top: "Canine parvovirus" provided by Jean-Yves Sgro*

*Bottom: "How genes build a fly" by Steve Paddock.*

In The Why Files Forum, anyone can discuss current science or technology events or the issues that drive science. Discussion topic areas include Astronomy, Biology/Chemistry, Physics/Math, The Earth, and Plants, Animals, and Humans. Post a message or a query!

The Why Files site has garnered many citations, including a "Top 25" Reference site by *PC Magazine*, Microsoft Network's "Pick of the Day," a "Top Five" web pick by the National Center for Supercomputing Applications at the University of Illinois, an InfiNet "Cool Site of the Day," and a Netscape "Cool Site."

periodicals, such as *Science* (160,000 weekly), *Science News* (225,000 weekly), and *Scientific American* (637,000 monthly), sell more magazines in a given time period than The Why Files has users. Based on these comparisons, then, certainly The Why Files does not currently have the broad reach of some of the more popular print publications.

There are advantages to attempts to communicate to the public via The Why Files. For instance, popular print magazines cost substantially more to produce than The Why Files and, thus, require not only a direct financial investment by readers (except for those who read them in public libraries or waiting rooms) but also a large contribution from advertising. Further, while these print magazines distribute only the current issue each week or month, The Why Files always maintains its complete history of packages online, thus serving as a searchable archive of SMET information as well as an up-to-date science magazine.

The patterns of use of The Why Files are indicative of novices in either the subject area or the medium. That is, past research indicates that novices tend to follow linear patterns through hypermedia systems and make use of instructional advice. This linear pattern, and making use of advice in the form of teasers that attempt to lure users to the next page in the narrative, were the modal patterns in our data. Little use was made of additional information in the glossary, bibliography, or links to other sites on the Web. However, it did appear that users were actively choosing the next linear page in the site, since use of presumably passive navigational features (buttons and the navigation bar) was infrequent compared to the selection of in-text links. Other SMET sites aimed at the general public might consider providing fewer links to outside sites and bibliographic information–which may disorient novice users–and devote more effort to providing a strong narrative flow and clear organization. These efforts should help users understand the structure not only of the site but of the knowledge domain in question.

So far we have learned much from our first look at The Why Files, and this information has been incorporated into some recent changes in the design of the site. Generally, we believe that The Why Files has the potential to serve as a useful template for future SMET-related sites. However, these initial studies cannot answer one key question: Can a well-designed Web site help users understand science as well as a paper publication does? This descriptive work now gives us a foundation from which to design the research that can answer this question.

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[1] The description of The Why Files was accurate at the time our research was conducted. Recent modifications to the design of the site make some of this description out of date.

[2] During the two-week period in which the survey data were collected, approximately 24,000 individuals visited The Why Files. The reader may wonder: "Why is the sample size only 399 if the response rate is 63% and 24,000 individuals visited the site?" To be asked to complete the survey, individuals must have visited the site at least three times during the two-week period before the survey or during the survey period itself. Only a small percentage of these 24,000 people met our selection criteria.

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*Very thoughtful reviews of earlier versions of this Brief have been provided by Andrew Porter, NISE Co-Director; Jane Butler Kahle, Miami University; Alan McGowan, American Association for the Advancement of Science; Shyam Sundar Sethuraman, Pennsylvania State University; and Larry Suter of the National Science Foundation.*

*The authors also would like to thank Darrell Schulte (Associate Information Processing Consultant at the University of Wisconsin–Madison and webmaster of The Why Files), Randall Ramig (at the time webmaster of the Civic Practices Network and OnLine Wisconsin and currently of the Microsoft Corporation), and Brian Deith (Information Processing Consultant at the University of Wisconsin–Madison) for their work on computer programming and data manipulation.*

*Photo on front cover by Jeff Miller*

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This *Brief* was supported by a cooperative agreement between the National Science Foundation and the University of Wisconsin-Madison (Cooperative Agreement No. RED-9452971). At UW-Madison, the National Institute for Science Education is housed in the Wisconsin Center for Education Research and is a collaborative effort of the College of Agricultural and Life Sciences, the School of Education, the College of Engineering, and the College of Letters and Science. The collaborative effort also is joined by the National Center for Improving Science Education in Washington, DC. Any opinions, findings or conclusions herein are those of the author(s) and do not necessarily reflect the views of the supporting agencies.

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Vol. 2, No. 2 May, 1998

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